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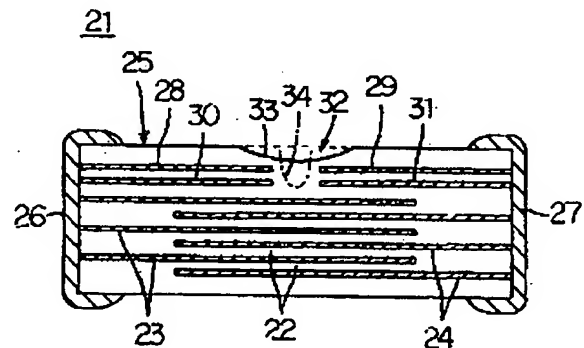
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(54) 【発明の名称】 積層セラミック電子部品およびそのトリミング方法

(57) 【要約】

【課題】 積層セラミックコンデンサのような容量成分を形成する積層セラミック電子部品の容量値を所望の値に調整するためのトリミングを、電極の除去によらずに行なえるようにし、電極の除去による耐候性の低下を防止する。

【解決手段】 内部導体として、互いの間で容量を形成するように、各々の端縁を互いに対向させた状態で突き合わせ電極28～31を形成し、対をなす突き合わせ電極28～31が対向する領域にトリミング予定部分32を設け、トリミング予定部分32においてセラミック層22を外部から部分的に除去することによって、突き合わせ電極28～31間で形成される容量を減少させるようにトリミングする。トリミング跡33、34には、突き合わせ電極28～31が露出しないため、耐候性が確保される。



の面を互いに対向させて容量を形成する複数対の内部電極を備えていてもよい。

【0015】この発明は、また、複数のセラミック層およびセラミック層の特定の界面に沿って形成される内部導体を有するセラミック積層体を備え、内部導体の少なくとも一部によって容量成分を形成するように構成され、さらに、内部導体が、互いの間で容量を形成するように、各々の端縁を互いに対向させた状態で配置される、少なくとも1対の突き合わせ電極を備えている、積層セラミック電子部品をトリミングする方法にも向けられ、上述した技術的課題を解決するため、対をなす突き合わせ電極が対向する領域においてセラミック層を外側から部分的に除去することによって、当該対をなす突き合わせ電極間で形成される容量を減少させるようにトリミングする工程を備えることを特徴としている。

【0016】上述したセラミック層を外側から除去する工程において、セラミック層における、突き合わせ電極の対向する端縁間に挟まれた部分より外側に位置する部分が除去されても、セラミック層における、突き合わせ電極の対向する端縁間に挟まれた部分が除去されても、これら双方が除去されてもよい。

【0017】

【発明の実施の形態】この発明は、容量成分を形成する積層セラミック電子部品全般に適用可能であるが、以下に、この発明の実施形態の説明を積層セラミックコンデンサに関連して行なう。図1は、この発明の一実施形態による積層セラミック電子部品としての積層セラミックコンデンサ21を示す断面図である。

【0018】積層セラミックコンデンサ21は、周知の積層セラミックコンデンサと同様、また、図3および図4に示した積層セラミックコンデンサ1および2と同様、複数のセラミック層22とセラミック層22の特定の界面に沿って形成される内部導体としての複数対の内部電極23および24とを有するセラミック積層体25を備える。各対をなす内部電極23および24は、各々の面を互いに対向させて容量を形成する。また、セラミック積層体25の各端部には、外部端子電極26および27が形成される。上述の各対をなす内部電極23および24のうち、一方の内部電極23は、外部端子電極26に接続され、他方の内部電極24は、外部端子電極27に接続される。このようにして、各対をなす内部電極23および24間にそれぞれ形成された容量は、外部端子電極26および27によって、並列接続されながら外部に取り出される。

【0019】このような構造の積層セラミックコンデンサ21において、トリミングを可能とするため、セラミック積層体25の内部であって、内部電極23および24が形成された位置より外側にあるセラミック層22の特定の界面に沿って、各々の端縁を互いに対向させた状態で、たとえば2対の突き合わせ電極28および29な

らびに30および31が形成されている。突き合わせ電極28および30は一方の外部端子電極26に接続され、突き合わせ電極29および31は他方の外部端子電極27に接続される。また、対をなす各一方の突き合わせ電極28および30と各他方の突き合わせ電極29および31とは、上述したような各端縁の対向によって互いの中に容量を形成し、これらの容量が、外部端子電極26および27によって取り出される。

【0020】このような積層セラミックコンデンサ21の全体としての容量を所望の値とするため、上述した突き合わせ電極28および30と突き合わせ電極29および31との間に形成される容量を減少させるようにトリミングされる。その目的で、セラミック積層体25には、対をなす突き合わせ電極28および30と突き合わせ電極29および31とが対向する領域においてセラミック層22を部分的に除去することが予定されたトリミング予定部分32が設けられる。

【0021】この実施形態のように、突き合わせ電極28～31が複数対形成される場合、各対をなす突き合わせ電極28～31のそれぞれの端縁は、セラミック積層体25の積層方向に整列されることが好ましい。これによって、突き合わせ電極28～31のいずれかがトリミング予定部分32内に突入することがなく、その結果、トリミング予定部分32を整った形状とすることができる。したがって、トリミング時において、突き合わせ電極28～31のいずれかを誤って除去してしまうことを防止でき、トリミング操作を容易にすることができる。

【0022】図1では、上述したトリミング予定部分32において、セラミック層22を外側から部分的に除去したトリミング跡33が実線で示され、また、別の態様でセラミック層22を外側から部分的に除去したトリミング跡34が1点鎖線で示されている。実線で示したトリミング跡33は、セラミック層22における、突き合わせ電極28～31の対向する端縁間に挟まれた部分より外側に位置する部分が除去された結果として形成されたものである。他方、1点鎖線で示したトリミング跡34は、セラミック層22における、突き合わせ電極28～31の対向する端縁間に挟まれた部分が除去された結果として形成されたものである。

【0023】これらトリミング跡33および34の各々は、セラミック積層体25の外側から、たとえばレーザービームを照射したり、サンドブラストを適用したりすることによって形成されるものであるが、その深さや幅が増すに従って、突き合わせ電極28および30と突き合わせ電極29および31との間で形成される容量が減少し、これに応じて、外部端子電極26および27間で取り出される積層セラミックコンデンサ21全体としての容量が減少する。したがって、このように容量が減少し、積層セラミックコンデンサ21全体としての容量が所望の値になるまで、トリミング操作が実施される。

例として、設計容量が2pFの積層セラミックコンデンサにおいて、たとえばトリミング跡34を形成するようなトリミングを実施したとき、設計容量の10%に当たる0.2pFの容量減少が確認された。

【0024】一般的に、トリミング跡33をもたらしようなトリミング態様は、容量値の必要な調整幅が比較的小さい場合に適し、トリミング跡34をもたらしようなトリミング態様は、容量値の必要な調整幅が比較的大きい場合に適している。したがって、必要とする容量値の調整幅の大きさに応じて、これらトリミング態様を使い分けられる。また、両者のトリミング態様が同時に採用されてもよい。

【0025】図2は、この発明の他の実施形態による積層セラミック電子部品としての積層セラミックコンデンサ41を示す断面図である。この積層セラミックコンデンサ41は、上述した積層セラミックコンデンサ21と共通する多くの要素を備えているので、図2において、図1に示す要素に相当する要素には同様の参照符号を付し、重複する説明は省略する。

【0026】図2に示した積層セラミックコンデンサ41は、トリミング予定部分がセラミック積層体25aの互に対向する両面のそれぞれに関連して設けられていることを特徴としている。すなわち、セラミック積層体25aの上面側に形成された突き合わせ電極28～31が対向する領域に設けられたトリミング予定部分32に加えて、セラミック積層体25aの下面側にも、たとえば2対の突き合わせ電極42および43ならびに44および45が形成され、これら突き合わせ電極42～45が対向する領域にトリミング予定部分47が設けられている。

【0027】より詳細には、セラミック積層体25aの内部であって、内部電極23および24が形成された位置より下側にあるセラミック層22の特定の界面に沿って、各々の端縁を互に対向させて容量を形成する状態で、2対の突き合わせ電極42および43ならびに44および45が形成されている。したがって、セラミック積層体25aには、対をなす突き合わせ電極42および44と突き合わせ電極43および45とが対向する領域においてセラミック層22を部分的に除去することが予定されたトリミング予定部分47が設けられる。

【0028】突き合わせ電極42および44は一方の外部端子電極26に接続され、突き合わせ電極43および45は他方の外部端子電極27に接続され、上述した突き合わせ電極42～45によって形成された容量は、外部端子電極26および27によって取り出される。したがって、積層セラミックコンデンサ41の全体としての容量を所望の値とするため、上述した突き合わせ電極42および44と突き合わせ電極43および45との間に形成される容量を減少させるようにトリミング予定部分47においてトリミングすることもできる。

【0029】このような積層セラミックコンデンサ41によれば、トリミング操作は、トリミング予定部分32および47のいずれに対しても行なうことができる。したがって、トリミングを実施するとき、積層セラミックコンデンサ41の表裏を区別したり、積層セラミックコンデンサ41を表裏に関して一定の方向に向けておいたりするといった煩雑な操作を必要としない。

【0030】また、トリミング操作は、積層セラミックコンデンサ41の製造段階で行なわれたり、回路基板への実装後に行なわれたりするが、実装後に行なう場合、特に注目すべきは、積層セラミックコンデンサ41が表裏いずれの側を上方向に向けて実装されても、トリミングを行なうことができるということである。以上、この発明を図示した積層セラミックコンデンサ21および41に関連して説明したが、この発明は、たとえばLC複合部品のように容量成分を形成するものである限り、他の積層セラミック電子部品にも適用することができる。

【0031】また、図示した実施形態では、1つのトリミング予定部分32または47に関して、2対の突き合わせ電極28～31または42～45が形成されたが、突き合わせ電極の対の数は任意であり、たとえば1対でも3対以上でもよい。

【0032】

【発明の効果】このように、この発明によれば、セラミック積層体に含まれる複数のセラミック層の特定の界面に沿って形成される内部導体として、互いの間で容量を形成するように、各々の端縁を互に対向させた状態で配置される、少なくとも1対の突き合わせ電極が形成され、トリミングにあたり、対をなす突き合わせ電極間で形成される容量を減少させて所望の容量値を得るようになるため、対をなす突き合わせ電極が対向する領域においてセラミック層を外部から部分的に除去することが行なわれる。したがって、この除去後のトリミング跡において、突き合わせ電極の断面を露出させたり、突き合わせ電極とセラミック層との界面を露出させたりすることがないので、トリミングによって積層セラミック電子部品の耐候性を劣化させることがない。

【0033】また、上述のように、トリミングにあたり、突き合わせ電極を除去せず、セラミック層を除去するので、たとえば突き合わせ電極をトリミング時に誤って分断して、容量値を激減させることがない。したがって、トリミングによる容量値の調整を失敗なく行なうことができる。また、突き合わせ電極を構成する金属の延展性が問題となり、容量の微調整を困難にすることもない。

【0034】この発明に係る積層セラミック電子部品において、トリミング予定部分が、セラミック積層体の互に対向する両面のそれぞれに関連して設けられていると、トリミング操作は、両面のトリミング予定部分のいずれに対しても行なうことができるようになるので、ト

## 【特許請求の範囲】

【請求項1】 複数のセラミック層および前記セラミック層の特定の界面に沿って形成される内部導体を有するセラミック積層体を備え、前記内部導体の少なくとも一部によって容量成分を形成するように構成された、積層セラミック電子部品であって、

前記内部導体は、互いの間で容量を形成するように、各々の端縁を互いに対向させた状態で配置される、少なくとも1対の突き合わせ電極を備え、

前記セラミック積層体には、対をなす前記突き合わせ電極間で形成される容量を減少させるようにトリミングするため、当該対をなす突き合わせ電極が対向する領域において前記セラミック層を外部から部分的に除去することが予定されたトリミング予定部分が設けられていることを特徴とする、積層セラミック電子部品。

【請求項2】 前記トリミング予定部分は、前記セラミック積層体の互いに対向する両面のそれぞれに関連して設けられている、請求項1に記載の積層セラミック電子部品。

【請求項3】 複数のセラミック層および前記セラミック層の特定の界面に沿って形成される内部導体を有するセラミック積層体を備え、前記内部導体の少なくとも一部によって容量成分を形成するように構成された、積層セラミック電子部品であって、

前記内部導体は、互いの間で容量を形成するように、各々の端縁を互いに対向させた状態で配置される、少なくとも1対の突き合わせ電極を備え、

前記セラミック積層体には、対をなす前記突き合わせ電極が対向する領域において前記セラミック層を外部から部分的に除去したトリミング跡が形成されていることを特徴とする、積層セラミック電子部品。

【請求項4】 前記内部導体は、複数対の前記突き合わせ電極を備え、各対をなす前記突き合わせ電極のそれぞれの端縁は、前記セラミック積層体の積層方向に整列される、請求項1ないし3のいずれかに記載の積層セラミック電子部品。

【請求項5】 前記内部導体は、さらに、各々の面を互いに対向させて容量を形成する複数対の内部電極を備える、請求項1ないし4のいずれかに記載の積層セラミック電子部品。

【請求項6】 複数のセラミック層および前記セラミック層の特定の界面に沿って形成される内部導体を有するセラミック積層体を備え、前記内部導体の少なくとも一部によって容量成分を形成するように構成され、さらに、前記内部導体は、互いの間で容量を形成するように、各々の端縁を互いに対向させた状態で配置される、少なくとも1対の突き合わせ電極を備えている、積層セラミック電子部品をトリミングする方法であって、対をなす前記突き合わせ電極が対向する領域において前記セラミック層を外部から部分的に除去することによ

て、当該対をなす突き合わせ電極間で形成される容量を減少させるようにトリミングする工程を備えることを特徴とする、積層セラミック電子部品のトリミング方法。

【請求項7】 前記セラミック層を外部から除去する工程において、前記セラミック層における、前記突き合わせ電極の対向する端縁間に挟まれた部分より外側に位置する部分が除去される、請求項6に記載の積層セラミック電子部品のトリミング方法。

【請求項8】 前記セラミック層を外部から除去する工程において、前記セラミック層における、前記突き合わせ電極の対向する端縁間に挟まれた部分が除去される、請求項6または7に記載の積層セラミック電子部品のトリミング方法。

## 【発明の詳細な説明】

## 【0001】

【発明の属する技術分野】この発明は、積層セラミック電子部品およびそのトリミング方法に関するもので、特に、たとえば積層セラミックコンデンサ、LC複合部品のように容量成分を形成している積層セラミック電子部品およびその容量調整のためのトリミング方法に関するものである。

## 【0002】

【従来の技術】たとえば積層セラミックコンデンサにおいて、積層セラミックコンデンサを完成させてから、静電容量の微調整のためのトリミングが行なわれることがある。このようなトリミングに適した積層セラミックコンデンサとして、図3または図4に示す構造のものが提案されている。

【0003】図3および図4に示した積層セラミックコンデンサ1および2は、ともに、周知の積層セラミックコンデンサと同様、複数のセラミック層3とセラミック層3の特定の界面に沿って形成される複数対の内部電極4および5とを有するセラミック積層体6を備える。各対をなす内部電極4および5は、各々の面を互いに対向させて容量を形成する。また、セラミック積層体6の各端部には、外部端子電極7および8が形成される。上述の各対をなす内部電極4および5のうち、一方の内部電極4は、外部端子電極7に接続され、他方の内部電極5は、外部端子電極8に接続される。このようにして、各対をなす内部電極4および5間にそれぞれ形成された容量は、外部端子電極7および8によって、並列接続されながら外部に取り出される。

【0004】このような構造の積層セラミックコンデンサ1および2において、トリミングを可能とするため、図3に示した積層セラミックコンデンサ1にあつては、セラミック積層体6の外表面上に、トリミング用外部電極9が形成され、セラミック積層体6の内部であつてセラミック層3の特定の界面に沿って、各々の端縁を互いに対向させた状態でトリミング用内部電極10および11が形成されている。トリミング用内部電極10および

11は、それぞれ、外部端子電極7および8に接続される。また、トリミング用内部電極10および11は、トリミング用外部電極9に対して各々の面を対向させて容量をそれぞれ形成している。これら容量は、トリミング用外部電極9によって直列接続されながら、外部端子電極7および8によって取り出される。

【0005】このような積層セラミックコンデンサ1の全体としての容量を所望の値とするようにトリミングするため、図3において破線で示すように、トリミング用外部電極9の少なくとも一部が除去される。これによって、トリミング用外部電極9とトリミング用内部電極10および/または11とが有効に対向する面積が少なくなり、トリミング用外部電極9とトリミング用内部電極10および11との対向によって形成される容量が減少して、所望の容量値が得られる。

【0006】他方、図4に示した積層セラミックコンデンサ2にあっては、セラミック積層体6の外表面上に、トリミング用外部電極12が形成され、セラミック積層体6の内部であってセラミック層3の特定の界面に沿って、トリミング用内部電極13が形成されている。トリミング用外部電極12は、外部端子電極8に接続され、トリミング用内部電極13は、外部端子電極7に接続される。また、トリミング用外部電極12とトリミング用内部電極13とは、各々の面を互に対向させて容量を形成し、この容量は、外部端子電極7および8によって取り出される。

【0007】このような積層セラミックコンデンサ2の全体としての容量を所望の値とするようにトリミングするため、図4において破線で示すように、トリミング用外部電極12の少なくとも一部が除去される。これによって、トリミング用外部電極12とトリミング用内部電極13とが有効に対向する面積が少なくなり、トリミング用外部電極12とトリミング用内部電極13との対向によって形成される容量が減少して、所望の容量値が得られる。

【0008】

【発明が解決しようとする課題】上述の図3および図4にそれぞれ示したトリミング方法は、それぞれ、トリミング用外部電極9および12の少なくとも一部を除去することによって容量を調整しようとするものである。で、トリミング後において、トリミング用外部電極9および12の断面が露出したり、トリミング用外部電極9および12とセラミック層3との界面が露出したりすることになり、これらの部分での耐候性の確保が必要となる。そのため、トリミング用外部電極9および12には、化学的に安定な材料を用いたり、あるいは、トリミング後において、トリミング用外部電極9および12の表面に、めっき、ガラスコート等の処置を施したりしなければならない。

【0009】また、上述のように、トリミング用外部電

極9および12の少なくとも一部を除去することによって容量を調整しようとするとき、トリミング用外部電極9および12の端部から順次除去するようにしないと、トリミング用電極9および12の分断が生じ、容量値が激減することがある。そのため、トリミング工程において、トリミング用外部電極9および12の除去すべき位置を正確に認識する必要がある、トリミング作業が煩雑になる。

【0010】また、トリミング用外部電極9および12には、銅または銀を用いることが多いが、このような金属は比較的延展性に富むため、トリミング用外部電極9および12がトリミングによって除去された領域と残された領域との境界線が明確に現れず、トリミングによって除去されたはずの領域にも、トリミング用外部電極9および12を構成する金属の一部が延び出すことがある。このことは、容量の微調整を困難にする。

【0011】そこで、この発明の目的は、上述した問題を解決し得る、積層セラミック電子部品およびそのトリミング方法を提供しようとするところである。

【0012】

【課題を解決するための手段】この発明は、複数のセラミック層およびセラミック層の特定の界面に沿って形成される内部導体を有するセラミック積層体を備え、内部導体の少なくとも一部によって容量成分を形成するように構成された、積層セラミック電子部品にまず向けられるものであって、上述した技術的課題を解決するため、内部導体が、互いの間で容量を形成するように、各々の端縁を互に対向させた状態で配置される、少なくとも1対の突き合わせ電極を備え、セラミック積層体には、対をなす突き合わせ電極間で形成される容量を減少させるようにトリミングするため、当該対をなす突き合わせ電極が対向する領域においてセラミック層を外部から部分的に除去することが予定されたトリミング予定部分が設けられていることを特徴としている。

【0013】上述の積層セラミック電子部品において、トリミング予定部分は、セラミック積層体の互に対向する両面のそれぞれに関連して設けられていることが好ましい。また、この発明に係る積層セラミック電子部品において、トリミング予定部分に対して既にトリミングが実施された場合、セラミック積層体には、対をなす突き合わせ電極が対向する領域においてセラミック層を外部から部分的に除去したトリミング跡が形成されている。

【0014】また、この発明に係る積層セラミック電子部品において、内部導体は、複数対の突き合わせ電極を備えていてもよい。この場合、各対をなす突き合わせ電極のそれぞれの端縁は、セラミック積層体の積層方向に整列されるのが好ましい。また、この発明に係る積層セラミック電子部品において、内部導体は、たとえば積層セラミックコンデンサを構成するように、さらに、各々

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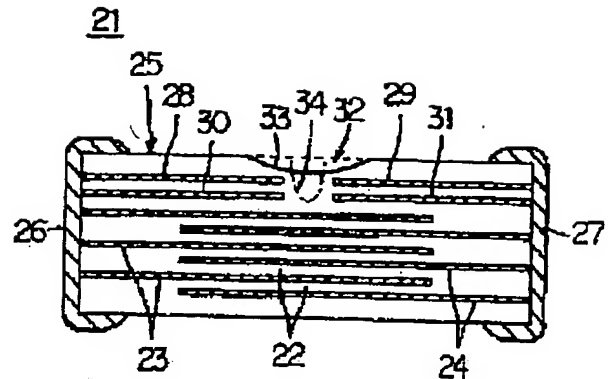
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APPLICANT : MURATA MFG CO LTD;

INVENTOR : ASAKURA NORIMASA;

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TITLE : LAMINATED CERAMIC ELECTRICAL  
PARTS AND ITS TRIMMING METHOD



**ABSTRACT :** **PROBLEM TO BE SOLVED:** To enable trimming for adjusting, without removing an electrode, the capacity value of laminated ceramic electrical parts forming a capacity element, such as a laminated ceramic capacitor to be a desired value and prevent the reduction of weatherability due to removal of electrode.

**SOLUTION:** Butted electrodes 28 to 31 for inner conductor are formed in a manner such that respective ends are arranged opposite to each other, so as to form a capacity therein, and a part 32 for trimming is provided to a region opposite to the paired butted electrodes 28 to 31, and then a ceramic layer 22 is partly removed from the outside in the part 32, so as to trim the part 32 for reducing the capacity formed among the electrodes 28 to 31. Since the electrodes 28 to 31 are not exposed to trimmed traces 33 and 34, weatherability can be ensured.

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リミングを実施するとき、積層セラミック電子部品の表裏を区別したり、積層セラミック電子部品を表裏に倒して一定の方向に向けておいたりするといった煩雑な操作を必要としないばかりでなく、トリミング操作を実装後に行なう場合、積層セラミック電子部品が表裏いずれの側を上方に向けて実装されても、トリミングを行なうことができる。

【0035】また、この発明に係る積層セラミック電子部品において、複数対の突き合わせ電極を備える場合、各対をなす突き合わせ電極のそれぞれの端縁が、セラミック積層体の積層方向に整列されていると、突き合わせ電極のいずれかがトリミング予定部分内に突入することがなく、その結果、トリミング予定部分を整った形状とすることができる。したがって、トリミング時において、突き合わせ電極のいずれかを誤って除去してしまうことを防止でき、トリミング操作を容易にすることができる。

【0036】この発明に係る積層セラミック電子部品のトリミング方法において、セラミック層を除去するとき、セラミック層における、突き合わせ電極の対向する端縁間に挟まれた部分より外側に位置する部分を除去するようにすれば、比較的小さい調整幅で容量値を調整することが容易になり、セラミック層における、突き合わ

せ電極の対向する端縁間に挟まれた部分を除去するようにすれば、比較的大きい調整幅で容量値を調整することが容易になる。

#### 【図面の簡単な説明】

【図1】この発明の一実施形態による積層セラミック電子部品としての積層セラミックコンデンサ21を示す断面図である。

【図2】この発明の他の実施形態による積層セラミック電子部品としての積層セラミックコンデンサ41を示す断面図である。

【図3】この発明にとって興味ある従来の積層セラミックコンデンサ1を示す断面図である。

【図4】この発明にとって興味ある従来の積層セラミックコンデンサ2を示す断面図である。

#### 【符号の説明】

21, 41 積層セラミックコンデンサ（積層セラミック電子部品）

22 セラミック層

23, 24 内部電極（内部導体）

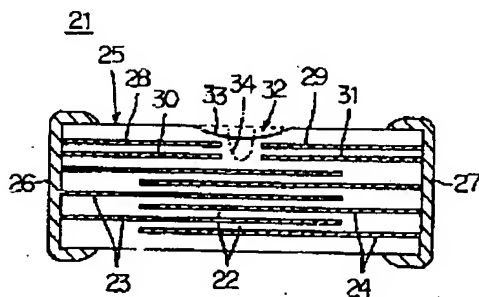
25, 25a セラミック積層体

28～31, 42～45 突き合わせ電極（内部導体）

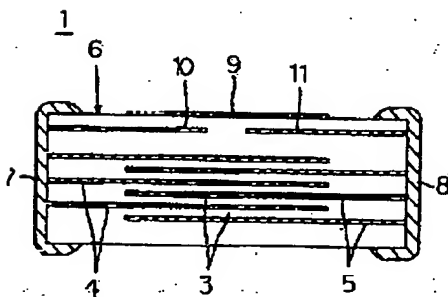
32, 47 トリミング予定部分

33, 34 トリミング跡

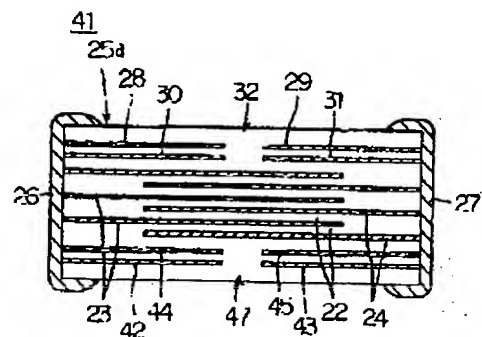
【図1】



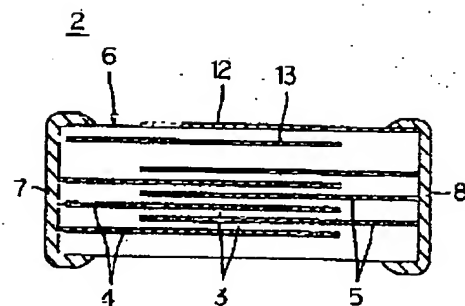
【図3】



【図2】



【図4】



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## DETAILED DESCRIPTION

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[Detailed Description of the Invention]

[0001]

[Field of the Invention] In this invention, it is related with a laminated ceramic electronic component and a trimming method for the same.

Therefore, it is especially related, for example with the trimming method for a laminated ceramic capacitor, the laminated ceramic electronic component which forms the capacity component like an LC composite part, and its capacity adjustment.

[0002]

[Description of the Prior Art] For example, in a laminated ceramic capacitor, since a laminated ceramic capacitor is completed, trimming for fine adjustment of electric capacity may be performed. As a laminated ceramic capacitor suitable for such trimming, the thing of the structure shown in drawing 3 or drawing 4 is proposed.

[0003] The laminated ceramic capacitors 1 and 2 shown in drawing 3 and drawing 4 are provided with the ceramic layered product 6 which both has two or more pairs of internal electrodes 4 and 5 formed over the specific interface of two or more ceramic layers 3 and the ceramic layer 3 like a well-known laminated ceramic capacitor. The internal electrodes 4 and 5 which make each set make each field counter mutually, and form capacity. The outer terminal electrodes 7 and 8 are formed in each end of the ceramic layered product 6. One internal electrode 4 is connected to the outer terminal electrode 7 among the internal electrodes 4 and 5 which make an above-mentioned each set, and the internal electrode 5 of another side is connected to the outer terminal electrode 8. Thus, with the outer terminal electrodes 7 and 8, the capacity formed between the internal electrode 4 which makes each set, and 5, respectively is taken out outside, while multiple connection is carried out.

[0004] If it is in the laminated ceramic capacitor 1 shown in drawing 3 in the laminated ceramic capacitors 1 and 2 of such a structure in order to make trimming possible, The exterior electrodes 9 for trimmings are formed on the outside surface of the ceramic layered product 6, it is an inside of the ceramic layered product 6, and the internal electrodes 10 and 11 for trimmings are formed in the state where each edge was made to counter mutually, over the specific interface of the ceramic layer 3. The internal electrodes 10 and 11 for trimmings are connected to the outer terminal electrodes 7 and



8, respectively. The internal electrodes 10 and 11 for trimmings make each field counter to the exterior electrodes 9 for trimmings, and form capacity, respectively. These capacity is taken out with the outer terminal electrodes 7 and 8, while a series connection is carried out with the exterior electrodes 9 for trimmings.

[0005]In order to carry out trimming so that it may be considered as the value of a request of the capacity as such a whole laminated ceramic capacitor 1, as a dashed line shows drawing 3, at least some exterior electrodes 9 for trimmings are removed. By this, the area which the exterior electrodes 9 for trimmings, the internal electrode 10 for trimmings, and/or 11 counter effectively decreases, the capacity formed by opposite with the exterior electrodes 9 for trimmings and the internal electrodes 10 and 11 for trimmings decreases, and desired capacity value is acquired.

[0006]On the other hand, if it is in the laminated ceramic capacitor 2 shown in drawing 4, on the outside surface of the ceramic layered product 6, the exterior electrodes 12 for trimmings are formed, it is an inside of the ceramic layered product 6, and the internal electrode 13 for trimmings is formed over the specific interface of the ceramic layer 3. The exterior electrodes 12 for trimmings are connected to the outer terminal electrode 8, and the internal electrode 13 for trimmings is connected to the outer terminal electrode 7. The exterior electrodes 12 for trimmings and the internal electrode 13 for trimmings make each field counter mutually, and form capacity, and this capacity is taken out with the outer terminal electrodes 7 and 8.

[0007]In order to carry out trimming so that it may be considered as the value of a request of the capacity as such a whole laminated ceramic capacitor 2, as a dashed line shows drawing 4, at least some exterior electrodes 12 for trimmings are removed. By this, the area which the exterior electrodes 12 for trimmings and the internal electrode 13 for trimmings counter effectively decreases, the capacity formed by opposite with the exterior electrodes 12 for trimmings and the internal electrode 13 for trimmings decreases, and desired capacity value is acquired.

[0008]

[Problem(s) to be Solved by the Invention]The trimming method shown in above-mentioned drawing 3 and drawing 4, respectively, Since it is going to adjust capacity by removing at least some exterior electrodes 9 and 12 for trimmings, respectively, After trimming, the section of the exterior electrodes 9 and 12 for trimmings will be exposed, or the interface of the exterior electrodes 9 and 12 for trimmings and the ceramic layer 3 will be exposed, and reservation of the weatherability in these portions is needed. Therefore, a stable material must be chemically used for the exterior electrodes 9 and 12 for trimmings, or it must deal with plating, a glass coat, etc. on the surface of the exterior electrodes 9 and 12 for trimmings after trimming.

[0009]When it is going to adjust capacity as mentioned above by removing at least some exterior electrodes 9 and 12 for trimmings, If it is not made not to remove from the end of the exterior electrodes 9 and 12 for trimmings one by one, division of the electrodes 9 and 12 for trimmings may arise, and capacity value may decrease sharply. Therefore, it is necessary to recognize correctly the position which should remove the exterior electrodes 9 and 12 for trimmings, and a trimming operation becomes complicated in a trimming process.

[0010]To the exterior electrodes 9 and 12 for trimmings. Although copper or silver is used in many cases, since such metal is comparatively rich in spread nature, The boundary line of the field where

the exterior electrodes 9 and 12 for trimmings were removed by trimming, and the left-behind field does not appear clearly, but some metal which constitutes the exterior electrodes 9 and 12 for trimmings also to the field which must have been removed by trimming may begin to be prolonged. This makes fine adjustment of capacity difficult.

[0011]Then, the purpose of this invention is to provide a laminated ceramic electronic component and a trimming method for the same which can solve the problem mentioned above.

[0012]

[Means for Solving the Problem]This invention is provided with a ceramic layered product which has an inner conductor formed over a specific interface of two or more ceramic layers and a ceramic layer, In order to solve a technical technical problem which it is first turned to a laminated ceramic electronic component of an inner conductor constituted so that a capacity component might therefore be formed in part at least, and was mentioned above, An inner conductor is provided with at least one pair of comparison electrodes arranged in the state where each edge was made to counter mutually, and them so that capacity may be formed in between [ mutual ] to a ceramic layered product. In order to carry out trimming so that capacity formed by the comparison inter-electrode which makes a pair may be decreased, it is characterized by providing a trimming schedule portion in which removing a ceramic layer selectively from the exterior in a field to which a comparison electrode which makes the pair concerned counters was planned.

[0013]As for a trimming schedule portion, in an above-mentioned laminated ceramic electronic component, it is preferred to be provided in relation to each of both sides where a ceramic layered product counters mutually. In a laminated ceramic electronic component concerning this invention, when trimming is already carried out to a trimming schedule portion, a trimming mark which removed a ceramic layer selectively from the exterior in a field to which a comparison electrode which makes a pair counters is formed in a ceramic layered product.

[0014]An inner conductor may be provided with two or more pairs of comparison electrodes in a laminated ceramic electronic component concerning this invention. In this case, as for each edge of a comparison electrode which makes each set, it is preferred to align in a laminating direction of a ceramic layered product. In a laminated ceramic electronic component concerning this invention, an inner conductor may be provided with two or more pairs of internal electrodes which make each field counter mutually and form capacity further so that a laminated ceramic capacitor may be constituted, for example.

[0015]This invention is provided with a ceramic layered product which has an inner conductor formed again over a specific interface of two or more ceramic layers and a ceramic layer, So that it may be constituted so that a capacity component may be formed as an inner conductor should boil a part at least, and an inner conductor may form capacity in between [ mutual ] further, In order to be turned also to a method provided with at least one pair of comparison electrodes arranged in the state where each edge was made to counter mutually of carrying out trimming of the laminated ceramic electronic component and to solve a technical technical problem mentioned above, By removing a ceramic layer selectively from the exterior in a field to which a comparison electrode which makes a pair counters, it is characterized by having a process which carries out trimming so that capacity formed by the comparison inter-electrode which makes the pair concerned may be decreased.

[0016]Even if a portion located outside a portion pinched in a process of removing a ceramic layer mentioned above from the exterior, between the edges where a comparison electrode in a ceramic layer counters is removed, A portion pinched between the edges where a comparison electrode in a ceramic layer counters may be removed, or these both sides may be removed.

[0017]

[Embodiment of the Invention]Although this invention is applicable to the laminated ceramic electronic component at large which forms a capacity component, it performs explanation of the embodiment of this invention to below in relation to a laminated ceramic capacitor. Drawing 1 is a sectional view showing the laminated ceramic capacitor 21 as a laminated ceramic electronic component by one embodiment of this invention.

[0018]The laminated ceramic capacitor 21 like a well-known laminated ceramic capacitor, It has the ceramic layered product 25 which has two or more pairs of internal electrodes 23 and 24 as an inner conductor formed over the specific interface of two or more ceramic layers 22 and the ceramic layer 22 like the laminated ceramic capacitors 1 and 2 shown in drawing 3 and drawing 4. The internal electrodes 23 and 24 which make each set make each field counter mutually, and form capacity. The outer terminal electrodes 26 and 27 are formed in each end of the ceramic layered product 25. One internal electrode 23 is connected to the outer terminal electrode 26 among the internal electrodes 23 and 24 which make an above-mentioned each set, and the internal electrode 24 of another side is connected to the outer terminal electrode 27. Thus, with the outer terminal electrodes 26 and 27, the capacity formed between the internal electrode 23 which makes each set, and 24, respectively is taken out outside, while multiple connection is carried out.

[0019]In order to make trimming possible in the laminated ceramic capacitor 21 of such a structure, It is an inside of the ceramic layered product 25, and is in the state which each edge was made to counter mutually over the specific interface of the ceramic layer 22 which exists outside the position in which the internal electrodes 23 and 24 were formed, and two pairs of comparison electrodes 28 and 29, and 30 and 31 are formed, for example. The comparison electrodes 28 and 30 are connected to one outer terminal electrode 26, and the comparison electrodes 29 and 31 are connected to the outer terminal electrode 27 of another side. By opposite of each edge which was mentioned above, the comparison electrodes 28 and 30 of one way each and the comparison electrodes 29 and 31 of each another side which make a pair form capacity, while it is mutual, and such capacity is taken out with the outer terminal electrodes 26 and 27.

[0020]In order to consider it as the value of a request of the capacity as such a whole laminated ceramic capacitor 21, trimming is carried out so that the capacity which compares with the comparison electrodes 28 and 30 mentioned above, and is formed among the electrodes 29 and 31 may be decreased. The trimming schedule portion 32 in which removing the ceramic layer 22 selectively for the purpose in the field to which it compares with the comparison electrodes 28 and 30 which make a pair to the ceramic layered product 25, and the electrodes 29 and 31 counter it was planned is formed.

[0021]Like this embodiment, as for each edge of the comparison electrodes 28-31 which make each set, when the comparison electrodes 28-31 are formed two or more pairs, it is preferred to align in the laminating direction of the ceramic layered product 25. It can be considered as the shape which either

of the comparison electrodes 28-31 did not rush in into the trimming schedule portion 32, and was ready in the trimming schedule portion 32 as a result by this. Therefore, at the time of trimming, it can prevent removing either of the comparison electrodes 28-31 accidentally, and trimming operation can be made easy.

[0022]In drawing 1, the trimming mark 34 which the trimming mark 33 which removed the ceramic layer 22 selectively from the exterior was shown by the solid line, and removed the ceramic layer 22 selectively from the exterior in another mode is shown by the dashed line in the trimming schedule portion 32 mentioned above. The trimming mark 33 shown as the solid line is formed as a result from which the portion located outside the portion pinched between the edges where the comparison electrodes 28-31 in the ceramic layer 22 counter was removed. On the other hand, the trimming mark 34 shown with the dashed line is formed as a result from which the portion pinched between the edges where the comparison electrodes 28-31 in the ceramic layer 22 counter was removed.

[0023]Although each of these trimming marks 33 and 34 is formed by irradiating with a laser beam, for example, or applying sandblasting from the outside of the ceramic layered product 25, The capacity which compares with the comparison electrodes 28 and 30, and is formed among the electrodes 29 and 31 decreases, and the capacity as the laminated ceramic capacitor 21 whole taken out between the outer terminal electrode 26 and 27 decreases according to this as the depth and width increase. Therefore, trimming operation is carried out until capacity decreases in this way and the capacity as the laminated ceramic capacitor 21 whole reaches a desired value. As an example, when trimming which forms the trimming mark 34 in the laminated ceramic capacitor whose design capacity is 2 pF was carried out, the 0.2-pF capacity drop equivalent to 10% of design capacity was checked.

[0024]Generally, a trimming mode which brings about the trimming mark 33 is suitable, when the span of adjustable range which needs capacity value is comparatively small, and a trimming mode which brings about the trimming mark 34 is suitable when the span of adjustable range which needs capacity value is comparatively large. Therefore, according to the size of the span of adjustable range of the capacity value to need, these trimming mode is used properly. Both trimming mode may be adopted simultaneously.

[0025]Drawing 2 is a sectional view showing the laminated ceramic capacitor 41 as a laminated ceramic electronic component by other embodiments of this invention. Since this laminated ceramic capacitor 41 is provided with many elements which are common in the laminated ceramic capacitor 21 mentioned above, in drawing 2, it gives the same reference mark to the element equivalent to the element shown in drawing 1, and omits the overlapping explanation to it.

[0026]The laminated ceramic capacitor 41 shown in drawing 2 is characterized by providing the trimming schedule portion in relation to each of both sides where the ceramic layered product 25a counters mutually. Namely, it adds to the trimming schedule portion 32 provided in the field to which the comparison electrodes 28-31 formed in the upper surface side of the ceramic layered product 25a counter, Two pairs of comparison electrodes 42 and 43, and 44 and 45 are formed also in the undersurface side of the ceramic layered product 25a, for example, and the trimming schedule portion 47 is formed in the field to which these comparison electrodes 42-45 counter.

[0027]It is in the state which is an inside of the ceramic layered product 25a, makes each edge

counter details mutually and forms capacity in them over the specific interface of the ceramic layer 22 which is below the position in which the internal electrodes 23 and 24 were formed more, Two pairs of comparison electrodes 42 and 43, and 44 and 45 are formed. Therefore, the trimming schedule portion 47 in which removing the ceramic layer 22 selectively in the field to which it compares with the comparison electrodes 42 and 44 which make a pair, and the electrodes 43 and 45 counter was planned is formed in the ceramic layered product 25a.

[0028]The comparison electrodes 42 and 44 are connected to one outer terminal electrode 26, the comparison electrodes 43 and 45 are connected to the outer terminal electrode 27 of another side, and the capacity formed of the comparison electrodes 42-45 mentioned above is taken out with the outer terminal electrodes 26 and 27. Therefore, since it is considered as the value of a request of the capacity as the whole laminated ceramic capacitor 41, in the trimming schedule portion 47, trimming can also be carried out so that the capacity which compares with the comparison electrodes 42 and 44 mentioned above, and is formed among the electrodes 43 and 45 may be decreased.

[0029]According to such a laminated ceramic capacitor 41, trimming operation can be performed also to any of the trimming schedule portions 32 and 47. Therefore, when carrying out trimming, complicated operation of distinguishing the rear surface of the laminated ceramic capacitor 41, or turning the laminated ceramic capacitor 41 in the fixed direction about a rear surface is not needed.

[0030]Trimming operation is performed by the manufacturing stage of the laminated ceramic capacitor 41, or after mounting to the circuit board, are carried out, but, the case where it carries out after mounting -- especially -- it should observe -- even if the laminated ceramic capacitor 41 turns which [ of a rear surface ] side up and is mounted, I hear that trimming can be performed and it is. As mentioned above, although it explained in relation to the laminated ceramic capacitors 21 and 41 illustrating this invention, this invention is applicable to other laminated ceramic electronic components, as long as a capacity component is formed, for example like an LC composite part.

[0031]In the illustrated embodiment, although two pairs of comparison electrodes 28-31, or 42-45 were formed about the one trimming schedule portion 32 or 47, a pair of number of comparison electrodes may be arbitrary, for example, one pair or three pairs or more may be sufficient as it.

[0032]

[Effect of the Invention]Thus, so that capacity may be formed in between [ mutual ] as an inner conductor formed over the specific interface of two or more ceramic layers contained in a ceramic layered product according to this invention, In order to form at least one pair of comparison electrodes arranged in the state where each edge was made to counter mutually, to decrease the capacity formed by the comparison inter-electrode which makes a pair in trimming and to acquire desired capacity value, Removing a ceramic layer selectively from the exterior in the field to which the comparison electrode which makes a pair counters is performed. Therefore, in the trimming mark after this removal, since the section of a comparison electrode is not exposed or the interface of a comparison electrode and a ceramic layer is not exposed, the weatherability of a laminated ceramic electronic component is not degraded with trimming.

[0033]Since a comparison electrode is not removed but a ceramic layer is removed in trimming as mentioned above, a comparison electrode is accidentally divided at the time of trimming, for example, and capacity value is not made to decrease sharply. Therefore, the capacity value by trimming can be

adjusted successful. The spread nature of the metal which constitutes a comparison electrode poses a problem, and does not make fine adjustment of capacity difficult.

[0034]When the trimming schedule portion is provided in the laminated ceramic electronic component concerning this invention in relation to each of both sides where a ceramic layered product counters mutually, trimming operation, Since it can carry out now also to any of a double-sided trimming schedule portion, When carrying out trimming, distinguish the rear surface of a laminated ceramic electronic component, or. Trimming can be performed, even if a laminated ceramic electronic component turns which [ of a rear surface ] side up and is mounted, when carrying out it not only not needing complicated operation of turning a laminated ceramic electronic component in the fixed direction about a rear surface, but after mounting trimming operation.

[0035]If each edge of the comparison electrode which makes each set has aligned in the laminated ceramic electronic component concerning this invention in the laminating direction of the ceramic layered product when it has two or more pairs of comparison electrodes, It can be considered as the shape which either of the comparison electrodes did not rush in into the trimming schedule portion, and was ready in the trimming schedule portion as a result. Therefore, at the time of trimming, it can prevent removing either of the comparison electrodes accidentally, and trimming operation can be made easy.

[0036]In the trimming method of the laminated ceramic electronic component concerning this invention, If the portion located outside the portion pinched between the edges where the comparison electrode in a ceramic layer counters is removed when removing a ceramic layer, It becomes easy to adjust capacity value by a comparatively small span of adjustable range, and if the portion pinched between the edges where the comparison electrode in a ceramic layer counters is removed, it will become easy to adjust capacity value by a comparatively large span of adjustable range.

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[Translation done.]

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## DETAILED DESCRIPTION

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[Detailed Description of the Invention]

[0001]

[Field of the Invention] In this invention, it is related with a laminated ceramic electronic component and a trimming method for the same.

Therefore, it is especially related, for example with the trimming method for a laminated ceramic capacitor, the laminated ceramic electronic component which forms the capacity component like an LC composite part, and its capacity adjustment.

[0002]

[Description of the Prior Art] For example, in a laminated ceramic capacitor, since a laminated ceramic capacitor is completed, trimming for fine adjustment of electric capacity may be performed. As a laminated ceramic capacitor suitable for such trimming, the thing of the structure shown in drawing 3 or drawing 4 is proposed.

[0003] The laminated ceramic capacitors 1 and 2 shown in drawing 3 and drawing 4 are provided with the ceramic layered product 6 which both has two or more pairs of internal electrodes 4 and 5 formed over the specific interface of two or more ceramic layers 3 and the ceramic layer 3 like a well-known laminated ceramic capacitor. The internal electrodes 4 and 5 which make each set make each field counter mutually, and form capacity. The outer terminal electrodes 7 and 8 are formed in each end of the ceramic layered product 6. One internal electrode 4 is connected to the outer terminal electrode 7 among the internal electrodes 4 and 5 which make an above-mentioned each set, and the internal electrode 5 of another side is connected to the outer terminal electrode 8. Thus, with the outer terminal electrodes 7 and 8, the capacity formed between the internal electrode 4 which makes each set, and 5, respectively is taken out outside, while multiple connection is carried out.

[0004] If it is in the laminated ceramic capacitor 1 shown in drawing 3 in the laminated ceramic capacitors 1 and 2 of such a structure in order to make trimming possible, The exterior electrodes 9 for trimmings are formed on the outside surface of the ceramic layered product 6, it is an inside of the ceramic layered product 6, and the internal electrodes 10 and 11 for trimmings are formed in the state where each edge was made to counter mutually, over the specific interface of the ceramic layer 3. The internal electrodes 10 and 11 for trimmings are connected to the outer terminal electrodes 7 and

8, respectively. The internal electrodes 10 and 11 for trimmings make each field counter to the exterior electrodes 9 for trimmings, and form capacity, respectively. These capacity is taken out with the outer terminal electrodes 7 and 8, while a series connection is carried out with the exterior electrodes 9 for trimmings.

[0005]In order to carry out trimming so that it may be considered as the value of a request of the capacity as such a whole laminated ceramic capacitor 1, as a dashed line shows drawing 3, at least some exterior electrodes 9 for trimmings are removed. By this, the area which the exterior electrodes 9 for trimmings, the internal electrode 10 for trimmings, and/or 11 counter effectively decreases, the capacity formed by opposite with the exterior electrodes 9 for trimmings and the internal electrodes 10 and 11 for trimmings decreases, and desired capacity value is acquired.

[0006]On the other hand, if it is in the laminated ceramic capacitor 2 shown in drawing 4, on the outside surface of the ceramic layered product 6, the exterior electrodes 12 for trimmings are formed, it is an inside of the ceramic layered product 6, and the internal electrode 13 for trimmings is formed over the specific interface of the ceramic layer 3. The exterior electrodes 12 for trimmings are connected to the outer terminal electrode 8, and the internal electrode 13 for trimmings is connected to the outer terminal electrode 7. The exterior electrodes 12 for trimmings and the internal electrode 13 for trimmings make each field counter mutually, and form capacity, and this capacity is taken out with the outer terminal electrodes 7 and 8.

[0007]In order to carry out trimming so that it may be considered as the value of a request of the capacity as such a whole laminated ceramic capacitor 2, as a dashed line shows drawing 4, at least some exterior electrodes 12 for trimmings are removed. By this, the area which the exterior electrodes 12 for trimmings and the internal electrode 13 for trimmings counter effectively decreases, the capacity formed by opposite with the exterior electrodes 12 for trimmings and the internal electrode 13 for trimmings decreases, and desired capacity value is acquired.

[0008]

[Problem(s) to be Solved by the Invention]The trimming method shown in above-mentioned drawing 3 and drawing 4, respectively, Since it is going to adjust capacity by removing at least some exterior electrodes 9 and 12 for trimmings, respectively, After trimming, the section of the exterior electrodes 9 and 12 for trimmings will be exposed, or the interface of the exterior electrodes 9 and 12 for trimmings and the ceramic layer 3 will be exposed, and reservation of the weatherability in these portions is needed. Therefore, a stable material must be chemically used for the exterior electrodes 9 and 12 for trimmings, or it must deal with plating, a glass coat, etc. on the surface of the exterior electrodes 9 and 12 for trimmings after trimming.

[0009]When it is going to adjust capacity as mentioned above by removing at least some exterior electrodes 9 and 12 for trimmings, If it is not made not to remove from the end of the exterior electrodes 9 and 12 for trimmings one by one, division of the electrodes 9 and 12 for trimmings may arise, and capacity value may decrease sharply. Therefore, it is necessary to recognize correctly the position which should remove the exterior electrodes 9 and 12 for trimmings, and a trimming operation becomes complicated in a trimming process.

[0010]To the exterior electrodes 9 and 12 for trimmings. Although copper or silver is used in many cases, since such metal is comparatively rich in spread nature, The boundary line of the field where



the exterior electrodes 9 and 12 for trimmings were removed by trimming, and the left-behind field does not appear clearly, but some metal which constitutes the exterior electrodes 9 and 12 for trimmings also to the field which must have been removed by trimming may begin to be prolonged. This makes fine adjustment of capacity difficult.

[0011]Then, the purpose of this invention is to provide a laminated ceramic electronic component and a trimming method for the same which can solve the problem mentioned above.

[0012]

[Means for Solving the Problem]This invention is provided with a ceramic layered product which has an inner conductor formed over a specific interface of two or more ceramic layers and a ceramic layer, In order to solve a technical technical problem which it is first turned to a laminated ceramic electronic component of an inner conductor constituted so that a capacity component might therefore be formed in part at least, and was mentioned above, An inner conductor is provided with at least one pair of comparison electrodes arranged in the state where each edge was made to counter mutually, and them so that capacity may be formed in between [ mutual ] to a ceramic layered product. In order to carry out trimming so that capacity formed by the comparison inter-electrode which makes a pair may be decreased, it is characterized by providing a trimming schedule portion in which removing a ceramic layer selectively from the exterior in a field to which a comparison electrode which makes the pair concerned counters was planned.

[0013]As for a trimming schedule portion, in an above-mentioned laminated ceramic electronic component, it is preferred to be provided in relation to each of both sides where a ceramic layered product counters mutually. In a laminated ceramic electronic component concerning this invention, when trimming is already carried out to a trimming schedule portion, a trimming mark which removed a ceramic layer selectively from the exterior in a field to which a comparison electrode which makes a pair counters is formed in a ceramic layered product.

[0014]An inner conductor may be provided with two or more pairs of comparison electrodes in a laminated ceramic electronic component concerning this invention. In this case, as for each edge of a comparison electrode which makes each set, it is preferred to align in a laminating direction of a ceramic layered product. In a laminated ceramic electronic component concerning this invention, an inner conductor may be provided with two or more pairs of internal electrodes which make each field counter mutually and form capacity further so that a laminated ceramic capacitor may be constituted, for example.

[0015]This invention is provided with a ceramic layered product which has an inner conductor formed again over a specific interface of two or more ceramic layers and a ceramic layer, So that it may be constituted so that a capacity component may be formed as an inner conductor should boil a part at least, and an inner conductor may form capacity in between [ mutual ] further, In order to be turned also to a method provided with at least one pair of comparison electrodes arranged in the state where each edge was made to counter mutually of carrying out trimming of the laminated ceramic electronic component and to solve a technical technical problem mentioned above, By removing a ceramic layer selectively from the exterior in a field to which a comparison electrode which makes a pair counters, it is characterized by having a process which carries out trimming so that capacity formed by the comparison inter-electrode which makes the pair concerned may be decreased.

[0016]Even if a portion located outside a portion pinched in a process of removing a ceramic layer mentioned above from the exterior, between the edges where a comparison electrode in a ceramic layer counters is removed, A portion pinched between the edges where a comparison electrode in a ceramic layer counters may be removed, or these both sides may be removed.

[0017]

[Embodiment of the Invention]Although this invention is applicable to the laminated ceramic electronic component at large which forms a capacity component, it performs explanation of the embodiment of this invention to below in relation to a laminated ceramic capacitor. Drawing 1 is a sectional view showing the laminated ceramic capacitor 21 as a laminated ceramic electronic component by one embodiment of this invention.

[0018]The laminated ceramic capacitor 21 like a well-known laminated ceramic capacitor, It has the ceramic layered product 25 which has two or more pairs of internal electrodes 23 and 24 as an inner conductor formed over the specific interface of two or more ceramic layers 22 and the ceramic layer 22 like the laminated ceramic capacitors 1 and 2 shown in drawing 3 and drawing 4. The internal electrodes 23 and 24 which make each set make each field counter mutually, and form capacity. The outer terminal electrodes 26 and 27 are formed in each end of the ceramic layered product 25. One internal electrode 23 is connected to the outer terminal electrode 26 among the internal electrodes 23 and 24 which make an above-mentioned each set, and the internal electrode 24 of another side is connected to the outer terminal electrode 27. Thus, with the outer terminal electrodes 26 and 27, the capacity formed between the internal electrode 23 which makes each set, and 24, respectively is taken out outside, while multiple connection is carried out.

[0019]In order to make trimming possible in the laminated ceramic capacitor 21 of such a structure, It is an inside of the ceramic layered product 25, and is in the state which each edge was made to counter mutually over the specific interface of the ceramic layer 22 which exists outside the position in which the internal electrodes 23 and 24 were formed, and two pairs of comparison electrodes 28 and 29, and 30 and 31 are formed, for example. The comparison electrodes 28 and 30 are connected to one outer terminal electrode 26, and the comparison electrodes 29 and 31 are connected to the outer terminal electrode 27 of another side. By opposite of each edge which was mentioned above, the comparison electrodes 28 and 30 of one way each and the comparison electrodes 29 and 31 of each another side which make a pair form capacity, while it is mutual, and such capacity is taken out with the outer terminal electrodes 26 and 27.

[0020]In order to consider it as the value of a request of the capacity as such a whole laminated ceramic capacitor 21, trimming is carried out so that the capacity which compares with the comparison electrodes 28 and 30 mentioned above, and is formed among the electrodes 29 and 31 may be decreased. The trimming schedule portion 32 in which removing the ceramic layer 22 selectively for the purpose in the field to which it compares with the comparison electrodes 28 and 30 which make a pair to the ceramic layered product 25, and the electrodes 29 and 31 counter it was planned is formed.

[0021]Like this embodiment, as for each edge of the comparison electrodes 28-31 which make each set, when the comparison electrodes 28-31 are formed two or more pairs, it is preferred to align in the laminating direction of the ceramic layered product 25. It can be considered as the shape which either

of the comparison electrodes 28-31 did not rush in into the trimming schedule portion 32, and was ready in the trimming schedule portion 32 as a result by this. Therefore, at the time of trimming, it can prevent removing either of the comparison electrodes 28-31 accidentally, and trimming operation can be made easy.

[0022]In drawing 1, the trimming mark 34 which the trimming mark 33 which removed the ceramic layer 22 selectively from the exterior was shown by the solid line, and removed the ceramic layer 22 selectively from the exterior in another mode is shown by the dashed line in the trimming schedule portion 32 mentioned above. The trimming mark 33 shown as the solid line is formed as a result from which the portion located outside the portion pinched between the edges where the comparison electrodes 28-31 in the ceramic layer 22 counter was removed. On the other hand, the trimming mark 34 shown with the dashed line is formed as a result from which the portion pinched between the edges where the comparison electrodes 28-31 in the ceramic layer 22 counter was removed.

[0023]Although each of these trimming marks 33 and 34 is formed by irradiating with a laser beam, for example, or applying sandblasting from the outside of the ceramic layered product 25, The capacity which compares with the comparison electrodes 28 and 30, and is formed among the electrodes 29 and 31 decreases, and the capacity as the laminated ceramic capacitor 21 whole taken out between the outer terminal electrode 26 and 27 decreases according to this as the depth and width increase. Therefore, trimming operation is carried out until capacity decreases in this way and the capacity as the laminated ceramic capacitor 21 whole reaches a desired value. As an example, when trimming which forms the trimming mark 34 in the laminated ceramic capacitor whose design capacity is 2 pF was carried out, the 0.2-pF capacity drop equivalent to 10% of design capacity was checked.

[0024]Generally, a trimming mode which brings about the trimming mark 33 is suitable, when the span of adjustable range which needs capacity value is comparatively small, and a trimming mode which brings about the trimming mark 34 is suitable when the span of adjustable range which needs capacity value is comparatively large. Therefore, according to the size of the span of adjustable range of the capacity value to need, these trimming mode is used properly. Both trimming mode may be adopted simultaneously.

[0025]Drawing 2 is a sectional view showing the laminated ceramic capacitor 41 as a laminated ceramic electronic component by other embodiments of this invention. Since this laminated ceramic capacitor 41 is provided with many elements which are common in the laminated ceramic capacitor 21 mentioned above, in drawing 2, it gives the same reference mark to the element equivalent to the element shown in drawing 1, and omits the overlapping explanation to it.

[0026]The laminated ceramic capacitor 41 shown in drawing 2 is characterized by providing the trimming schedule portion in relation to each of both sides where the ceramic layered product 25a counters mutually. Namely, it adds to the trimming schedule portion 32 provided in the field to which the comparison electrodes 28-31 formed in the upper surface side of the ceramic layered product 25a counter, Two pairs of comparison electrodes 42 and 43, and 44 and 45 are formed also in the undersurface side of the ceramic layered product 25a, for example, and the trimming schedule portion 47 is formed in the field to which these comparison electrodes 42-45 counter.

[0027]It is in the state which is an inside of the ceramic layered product 25a, makes each edge

counter details mutually and forms capacity in them over the specific interface of the ceramic layer 22 which is below the position in which the internal electrodes 23 and 24 were formed more, Two pairs of comparison electrodes 42 and 43, and 44 and 45 are formed. Therefore, the trimming schedule portion 47 in which removing the ceramic layer 22 selectively in the field to which it compares with the comparison electrodes 42 and 44 which make a pair, and the electrodes 43 and 45 counter was planned is formed in the ceramic layered product 25a.

[0028]The comparison electrodes 42 and 44 are connected to one outer terminal electrode 26, the comparison electrodes 43 and 45 are connected to the outer terminal electrode 27 of another side, and the capacity formed of the comparison electrodes 42-45 mentioned above is taken out with the outer terminal electrodes 26 and 27. Therefore, since it is considered as the value of a request of the capacity as the whole laminated ceramic capacitor 41, in the trimming schedule portion 47, trimming can also be carried out so that the capacity which compares with the comparison electrodes 42 and 44 mentioned above, and is formed among the electrodes 43 and 45 may be decreased.

[0029]According to such a laminated ceramic capacitor 41, trimming operation can be performed also to any of the trimming schedule portions 32 and 47. Therefore, when carrying out trimming, complicated operation of distinguishing the rear surface of the laminated ceramic capacitor 41, or turning the laminated ceramic capacitor 41 in the fixed direction about a rear surface is not needed.

[0030]Trimming operation is performed by the manufacturing stage of the laminated ceramic capacitor 41, or after mounting to the circuit board, are carried out, but, the case where it carries out after mounting -- especially -- it should observe -- even if the laminated ceramic capacitor 41 turns which [ of a rear surface ] side up and is mounted, I hear that trimming can be performed and it is. As mentioned above, although it explained in relation to the laminated ceramic capacitors 21 and 41 illustrating this invention, this invention is applicable to other laminated ceramic electronic components, as long as a capacity component is formed, for example like an LC composite part.

[0031]In the illustrated embodiment, although two pairs of comparison electrodes 28-31, or 42-45 were formed about the one trimming schedule portion 32 or 47, a pair of number of comparison electrodes may be arbitrary, for example, one pair or three pairs or more may be sufficient as it.

[0032]

[Effect of the Invention]Thus, so that capacity may be formed in between [ mutual ] as an inner conductor formed over the specific interface of two or more ceramic layers contained in a ceramic layered product according to this invention, In order to form at least one pair of comparison electrodes arranged in the state where each edge was made to counter mutually, to decrease the capacity formed by the comparison inter-electrode which makes a pair in trimming and to acquire desired capacity value, Removing a ceramic layer selectively from the exterior in the field to which the comparison electrode which makes a pair counters is performed. Therefore, in the trimming mark after this removal, since the section of a comparison electrode is not exposed or the interface of a comparison electrode and a ceramic layer is not exposed, the weatherability of a laminated ceramic electronic component is not degraded with trimming.

[0033]Since a comparison electrode is not removed but a ceramic layer is removed in trimming as mentioned above, a comparison electrode is accidentally divided at the time of trimming, for example, and capacity value is not made to decrease sharply. Therefore, the capacity value by trimming can be

adjusted successful. The spread nature of the metal which constitutes a comparison electrode poses a problem, and does not make fine adjustment of capacity difficult.

[0034]When the trimming schedule portion is provided in the laminated ceramic electronic component concerning this invention in relation to each of both sides where a ceramic layered product counters mutually, trimming operation, Since it can carry out now also to any of a double-sided trimming schedule portion, When carrying out trimming, distinguish the rear surface of a laminated ceramic electronic component, or. Trimming can be performed, even if a laminated ceramic electronic component turns which [ of a rear surface ] side up and is mounted, when carrying out it not only not needing complicated operation of turning a laminated ceramic electronic component in the fixed direction about a rear surface, but after mounting trimming operation.

[0035]If each edge of the comparison electrode which makes each set has aligned in the laminated ceramic electronic component concerning this invention in the laminating direction of the ceramic layered product when it has two or more pairs of comparison electrodes, It can be considered as the shape which either of the comparison electrodes did not rush in into the trimming schedule portion, and was ready in the trimming schedule portion as a result. Therefore, at the time of trimming, it can prevent removing either of the comparison electrodes accidentally, and trimming operation can be made easy.

[0036]In the trimming method of the laminated ceramic electronic component concerning this invention, If the portion located outside the portion pinched between the edges where the comparison electrode in a ceramic layer counters is removed when removing a ceramic layer, It becomes easy to adjust capacity value by a comparatively small span of adjustable range, and if the portion pinched between the edges where the comparison electrode in a ceramic layer counters is removed, it will become easy to adjust capacity value by a comparatively large span of adjustable range.

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[Translation done.]